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RESEARCH ARTICLE

CORRELATION OF PANCYTOPENIA AND VITAMIN B12 DEFICIENCY IN ANAEMIC ADOLESCENTS AGED 10-17 YEARS

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ABSTRACT

Anemia is a major global public health problem, especially in children and reproductive age women, affecting both developed and developing country. Vitamin B12 or Cobalamin (Cbl) is a water soluble vitamin. Cobalamin is synthesized by microorganisms present in the environment and in the intestines of animals. Pancytopenia is the reduction below the normal values of all the three peripheral linages of the blood namely erythrocytes, leucocytes and platelets. It is known that vitamin B12 deficiency causes megaloblastic anaemia as cobalamin is essential for the production of erythrocytes. Adolescents form the transition span of life between childhood and adulthood. Along with the growth spurt and the other changes associated with adolescence, the basic demand for nutrient supply also increases tremendously. Iron deficiency anaemia being the most common cause of anaemia, we wanted to study the correlation of pancytopenia and vitamin B12 deficiency in anaemic adolescents. 40 anaemic adolescents were enrolled in the study. The study shows there is a significant correlation between pancytopenia and Vitamin B12 deficiency.

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INTRODUCTION

Anemia can be defined as the reduction in the red cell mass or haemoglobin concentration below the normal range of the values occurring in healthy individuals[1]. Anemia is an important global health problem affecting the children and women of reproductive age group. Certain physiologic adjustments occur in anemia which include raised cardiac output, augmented extraction of oxygen and shunting of blood flow to vital tissues[2]. A population-based study in India, 14,300 children were studied and it shows that 28.4% of the adolescents were anaemic, and the major causes of anaemia were vitamin B12 deficiency (25.6%), iron deficiency (21.3%), dimorphic anaemia (18.2%), and anaemia of inflammation (3.4%)[3] Pancytopenia is a common hematological problem with a long list of differential diagnoses and still the optimal diagnostic approach to pancytopenia remains undefined[4]. The causes of Pancytopenia can be inherited or acquired. Inherited Pancytopenia could be due to Fanconi anemia, Schwachman Diamond Syndrome, Dyskeratosis Congenita, Congenital Amegakaryocytic Thrombocytopenia, Reticular Dysgenesis and other genetic syndromes etc. Acquired causes can be due to radiation, various drugs causing bone marrow suppression, chemicals, viruses, immune mediated, paroxysmal nocturnal hemoglobinuria and marrow replacement [5].

In children clinical manifestations of disease causing bone marrow suppression in turn causing pancytopenia includes fever, pallor, mucocutaneous bleed, hepatosplenomegaly and lymphadenopathy[6]. The most common causes of vitamin B12 deficiency include inadequate dietary intake in the pediatric population and pernicious anaemia forms the leading cause in adults[7]. Minimal literature examining anaemia among male and female adolescents aged 10–19 years is available in public domain[8]. Thus this study was undertaken to study the adolescent anaemics admitted to the tertiary care centre and to study the correlation of pancytopenia and vitamin B12 deficiency anaemia to further add data to the minimal available literature.

METHODOLOGY

A cross sectional study was conducted between. February 2021 and August 2022 in all the hospitals attached to Bangalore Medical College & Research Institute. The adolescent children aged between 10 years to 17 years were studied. The children aged 10 – 17 years, patient's parents/guardian willing to give informed consent were included. The patient's parents/guardian not willing to give informed consent, and other causes of anaemia including anaemia of bone marrow failure, haemolytic anaemia associated with jaundice and organomegaly, aplastic anemia, leukemia were excluded from the study.

General condition of the patient: Weakness/ fatigue/ anorexia/ failure to thrive, physical findings such as knuckle hyperpigmentation, glossitis, socio-demographic history,maternal history, feeding history, clinical examination including recording of vital signs, were recorded.

The blood samples collected and sent for investigations which included Complete blood count with Red cell indices, Peripheral Smear, reticulocyte count, Iron profile, TIBC, Vitamin B12 levels and serum folic acid levels. Anemia was diagnosed according to World Health Organisation (WHO) criteria.

Gender distribution		
	Frequency	Percent
Male	14	35.0
Female	26	65.0
Total	40	100.0

RESULTS

Kolmogorov Smirnov test was used to test the normality of the data.Chi-square test was used to assess the significance between categorical variables. Continuous variables are expressed in terms of Mean, Standard deviation (SD), median, interquartile range (IQR),Categorical variables are expressed in frequency (n) and percentage (%) $P < 0.05$ was considered as statistically significant, $P > 0.05$ was considered as statistically insignificant. Spearman's correlation was used to correlate B12 deficiency and pancytopenia.

Figure 1. Mean age of distribution

Mean age (in yrs)				
N	Minimum	Maximum	Mean	SD
40	10	17	14.51	2.147

Figure 3. Distribution of pancytopenia

Pancytopenia*Sex - Crosstab					
			B12 def		
			No	Yes	Total
SEX	Male	n	5	9	14
		%	27.80%	40.90%	35.00%
	Female	n	13	13	26
		%	72.20%	59.10%	65.00%
Total		n	18	22	40
		%	100.00%	100.00%	100.00%
Chi-square value – 0.75, p-value: 0.386					

The study was conducted on 40 anaemic adolescent patients aged 10-17 years. Predominantly consisted of Females 65%(n=26) and 35%(n=14) males. (Figure 1 and 2). Pancytopenia was found in 22 patients (Figure 3), and vitamin B12 deficiency was found in 19 patients. (Figure 4). It was found that the number of children with pancytopenia and vitamin B12 deficiency were 11, with a significant p value of 0.003, showing that the correlation is statistically significant. (Figure 5,6 and 7). And there is a positive correlation of pancytopenia and vitamin B12 deficiency.

Figure 4. Distribution of vitamin B12 deficiency

Pancytopenia + Vit B12 def*Sex - Crosstab					
			B12 def		
			No	Yes	Total
SEX	Male	n	10	4	14
		%	40.00%	26.70%	35.00%
	Female	n	15	11	26
		%	60.00%	73.30%	65.00%
Total		n	25	15	40
		%	100.00%	100.00%	100.00%
Chi-square value – 0.733, p-value: 0.392					

The clinical manifestations of the children were varied and included easy fatiguability 70%(n=28), loss of appetite 65%(n=26), knuckle hyperpigmentation 62.5%(n=25), severe pallor 62.5%(n=25), fever 22.5% (n=22), spleenomegaly 22.5% (n=9), Hepatomegaly 12.5%(n=5). Majority were early adolescents 52.5% (n=21) and late adolescents were 47.5%(n=19).

Figure 5. pancytopenia and vitamin B12 correlation

B12 def*Sex - Crosstab					
			B12 def		
			No	Yes	Total
SEX	Male	n	10	4	14
		%	47.60%	21.10%	35.00%
	Female	n	11	15	26
		%	52.40%	78.90%	65.00%
Total		n	21	19	40
		%	100.00%	100.00%	100.00%
Chi-square value – 3.095, p-value: 0.079					

*There is significant positive correlation

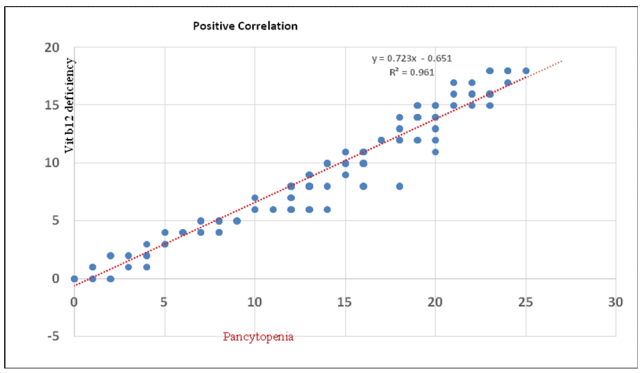

Figure 6. Correlation of vitamin B12 deficiency and pancytopenia

Figure 7. Correlation of vitamin B12 deficiency and pancytopenia

Spearman's correlation test		
Variables	Correlation coefficient	p-value
B12 deficiency and Pancytopenia	0.458	0.003*

DISCUSSION

In adolescents, anaemia has a role in physical disorders, growth and mental retardation and it also increases reproductive morbidities among adolescent girls during their reproductive age. Unfortunately, the programmes of anaemia intervention, such as the National Nutrition Anaemia Prophylaxis Programme, primarily targets infants, young children, pregnant and lactation women, and not adolescents. Anaemia among adolescents must be addressed through effective public health policy targeting adolescents residing in rural areas. The information about anaemia-related programs, such as National Iron Plus Initiative (NIPI), should be spread through mass media, and subsequently, the public health system may be prepared to tailor the needs of adolescent boys and girls[9]. The cause of pancytopenia varies enormously in children. It ranges from transient causes of marrow suppression such as viral infection to marrow infiltration by malignancy which can be life threatening. It may also be due to iatrogenic causes such as drugs, chemotherapy or radiotherapy for malignancies[10]. In our study we wanted to study the correlation of vitamin B12 deficiency and pancytopenia in adolescent children aged 10-17 years. Mahajan et al., in their study on adolescent boys and girls aged 14–18 years, observed that, the prevalence of anaemia of around 45% among adolescent girls and 16% among adolescent boys[11]. Anaemia which is more common among adolescents must be addressed through effective public health policies. Targeting adolescents who reside in poor households and rural areas is important. There is a need to spread awareness about anaemia-related programs through mass media. The public health system must be prepared to handle the needs of adolescent boys and girls[9].

CONCLUSION

There is minimal studies about the correlation between pancytopenia and vitamin B12 deficiency in anaemic adolescents. Hence the study was conducted to add further more to the available literature, and it was found that there is a positive correlation between pancytopenia and Vitamin B12 deficiency in anaemic adolescents. The study is statistically significant. Hence, treatment of these adolescents during this period with vitamin B12 will decrease the future morbidities associated with the severity of anaemia.

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